FIG. 1a

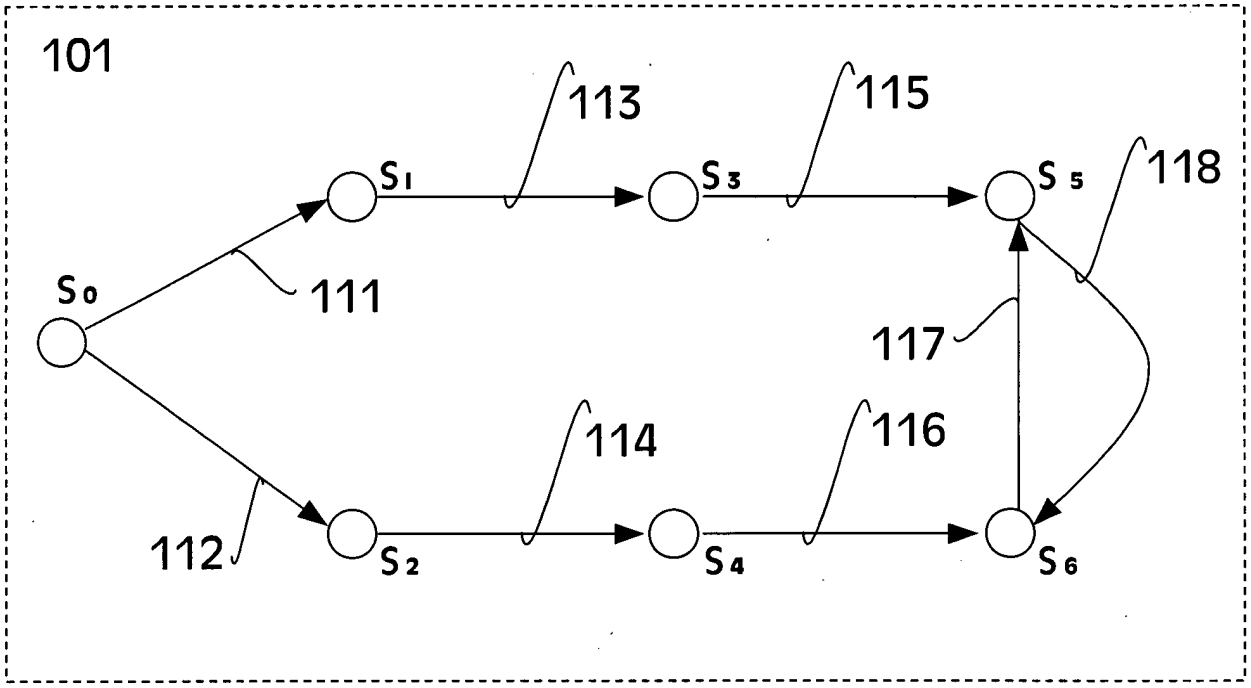

101
113
115
118
S1
S3
S5
S0
111
117
114
116
112
S2
S4
S6

FIG. 1b

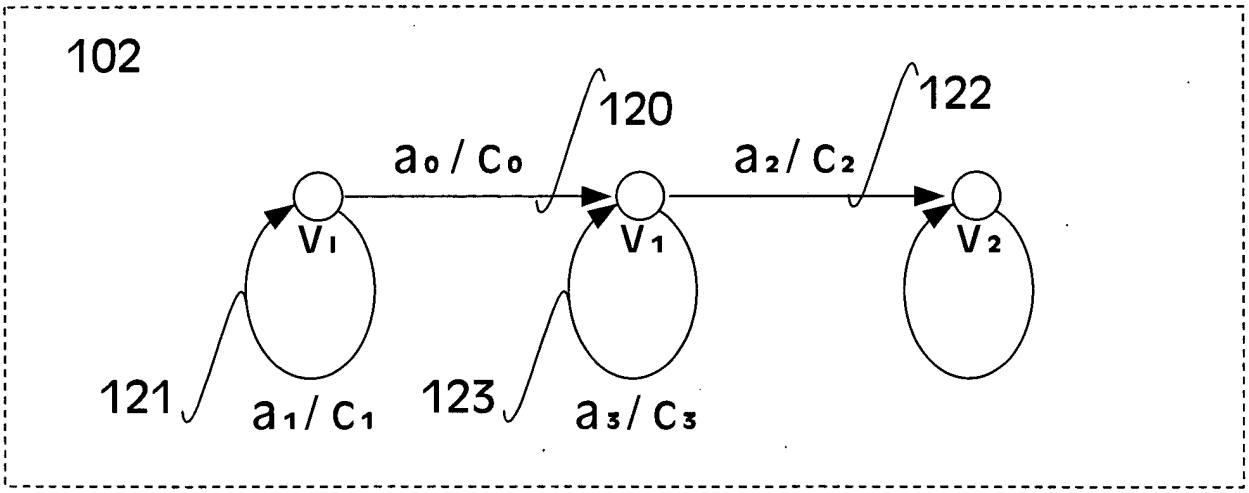

102
120
122
a0 / c0
a2 / c2
V1
V1
V2
121
123
a1 / c1
a3 / c3

FIG. 1c

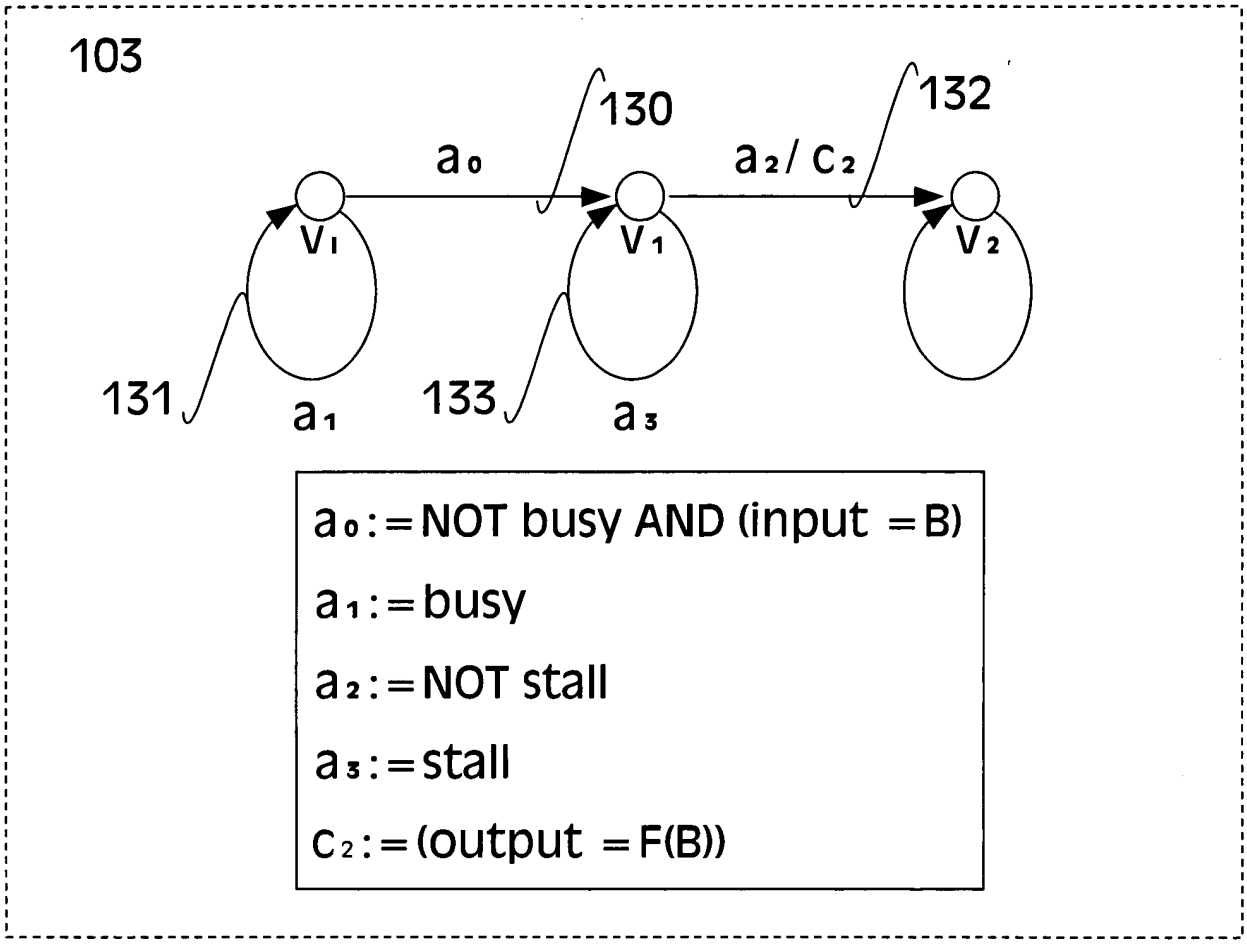

103
130
132
a_0
a_2 / c_2
V_1
V_1
V_2
131
133
a_1
a_3
a_0 := NOT busy AND (input = B)
a_1 := busy
a_2 := NOT stall
a_3 := stall
c_2 := (output = F(B))

FIG. 2a

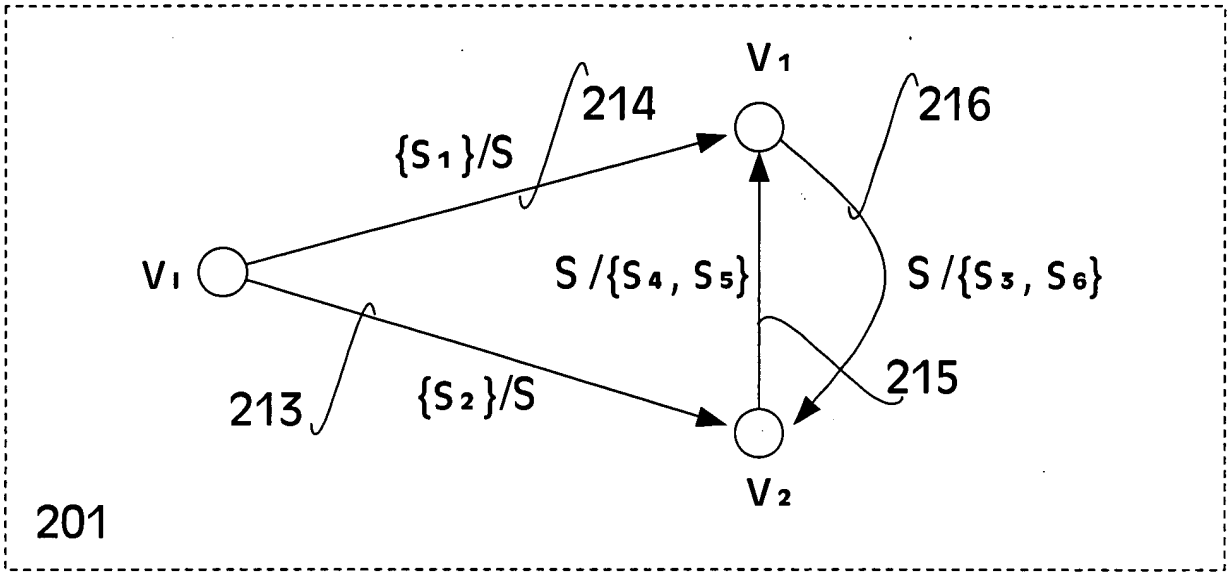

V1
214
216
{S1}/S
V1
S /{S4, S5}
S /{S3, S6}
213
{S2}/S
215
V2
201

FIG. 2b

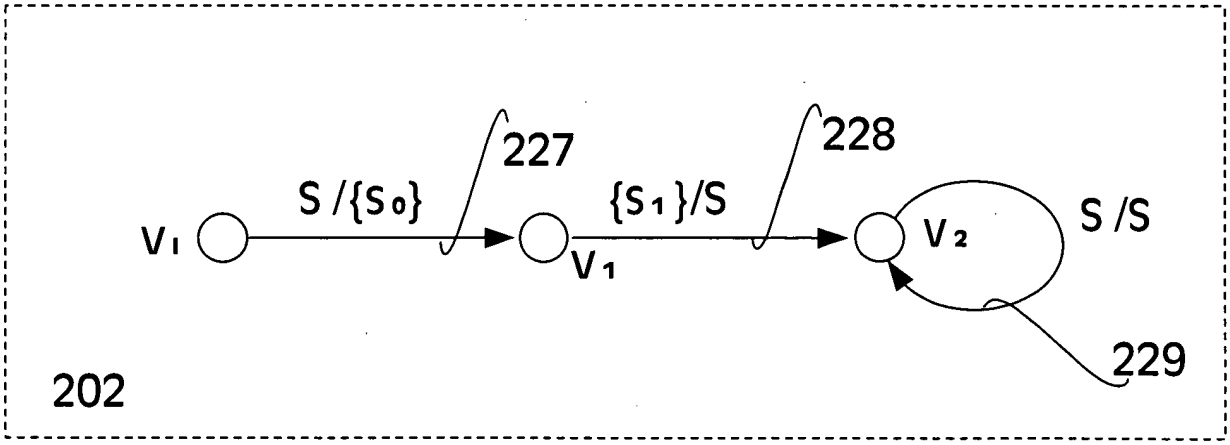

227
228
S /{S0}
{S1}/S
V1
V2
S /S
229
202

FIG. 3a

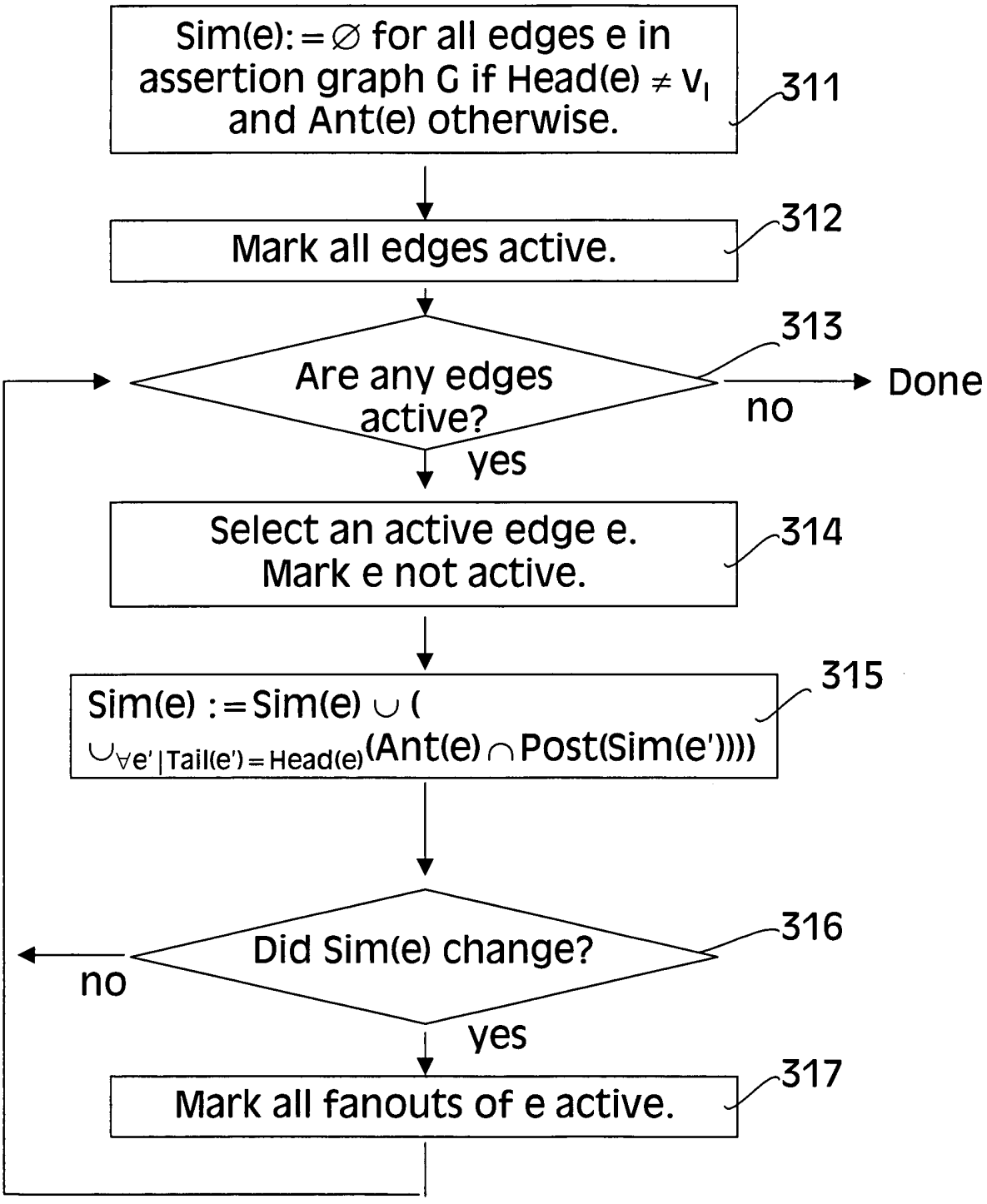

Sim(e):=∅ for all edges e in assertion graph G if Head(e) ≠ V_I and Ant(e) otherwise.
311
Mark all edges active.
312
Are any edges active?
313
Done
no
yes
Select an active edge e. Mark e not active.
314
Sim(e) := Sim(e) ∪ (∪∀e' | Tail(e') = Head(e) (Ant(e) ∩ Post(Sim(e'))))
315
Did Sim(e) change?
316
no
yes
Mark all fanouts of e active.
317

FIG. 3b

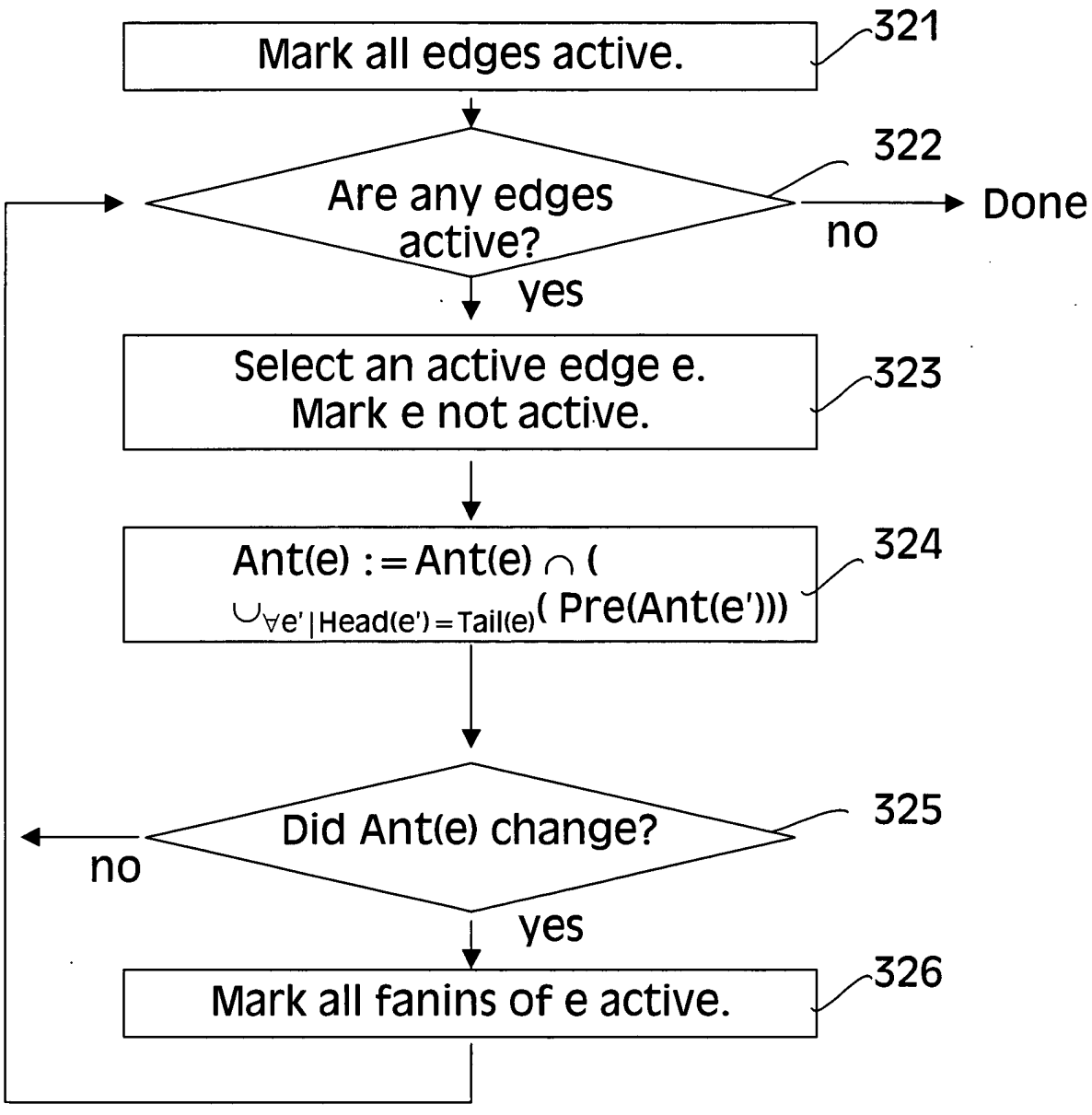

Mark all edges active.
321
Are any edges active?
322
no
Done
yes
Select an active edge e.
Mark e not active.
323
Ant(e) := Ant(e) ∩ (
∪∀e' | Head(e') = Tail(e) (Pre(Ant(e')))
324
Did Ant(e) change?
325
no
yes
Mark all fanins of e active.
326

FIG. 4

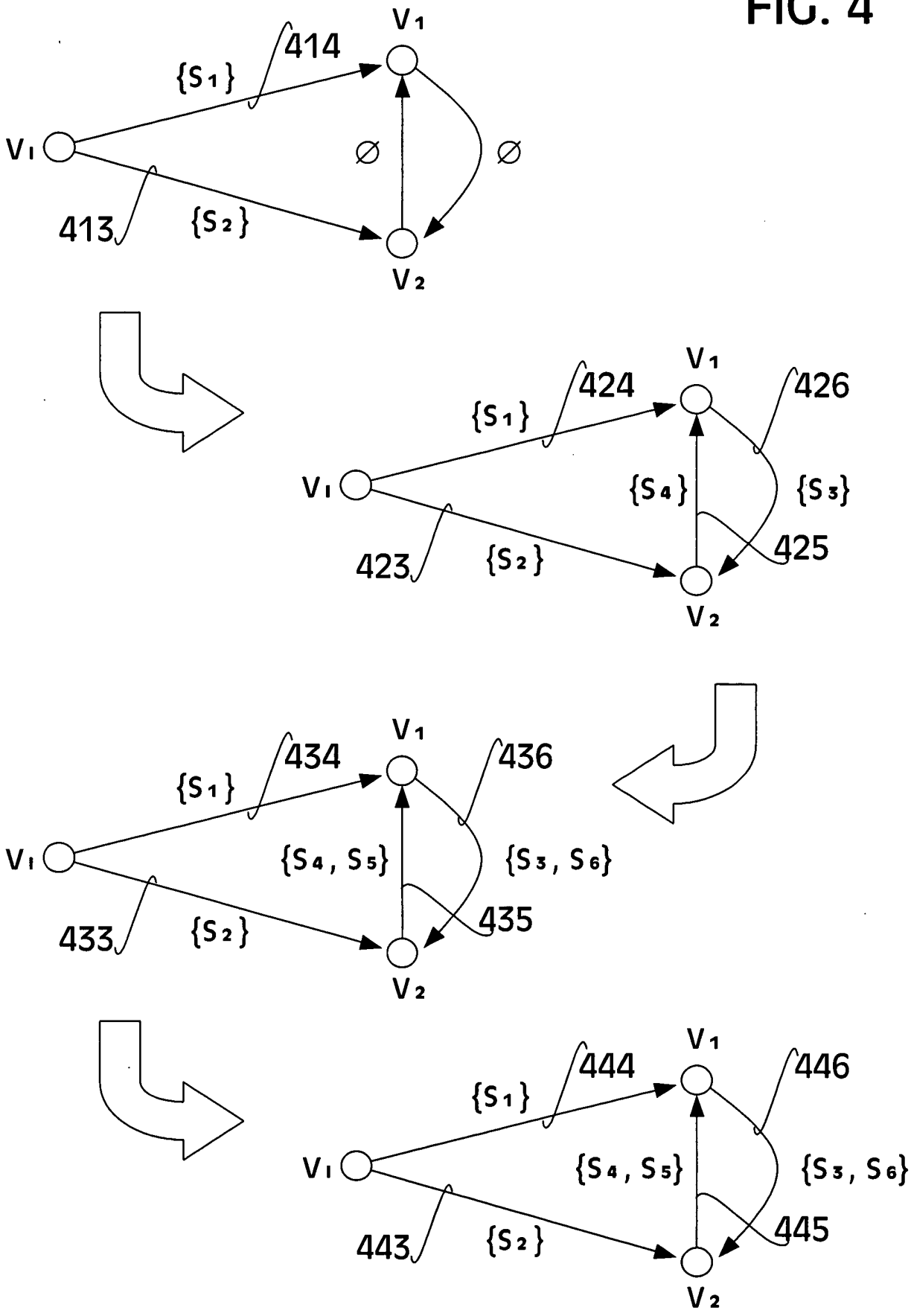

V1
414
{S1}
V1
∅
∅
413
{S2}
V2
424
426
V1
{S1}
V1
{S4}
{S3}
425
423
{S2}
V2
434
436
V1
{S1}
V1
{S4, S5}
{S3, S6}
435
433
{S2}
V2
444
446
V1
{S1}
V1
{S4, S5}
{S3, S6}
445
443
{S2}
V2

FIG. 5a

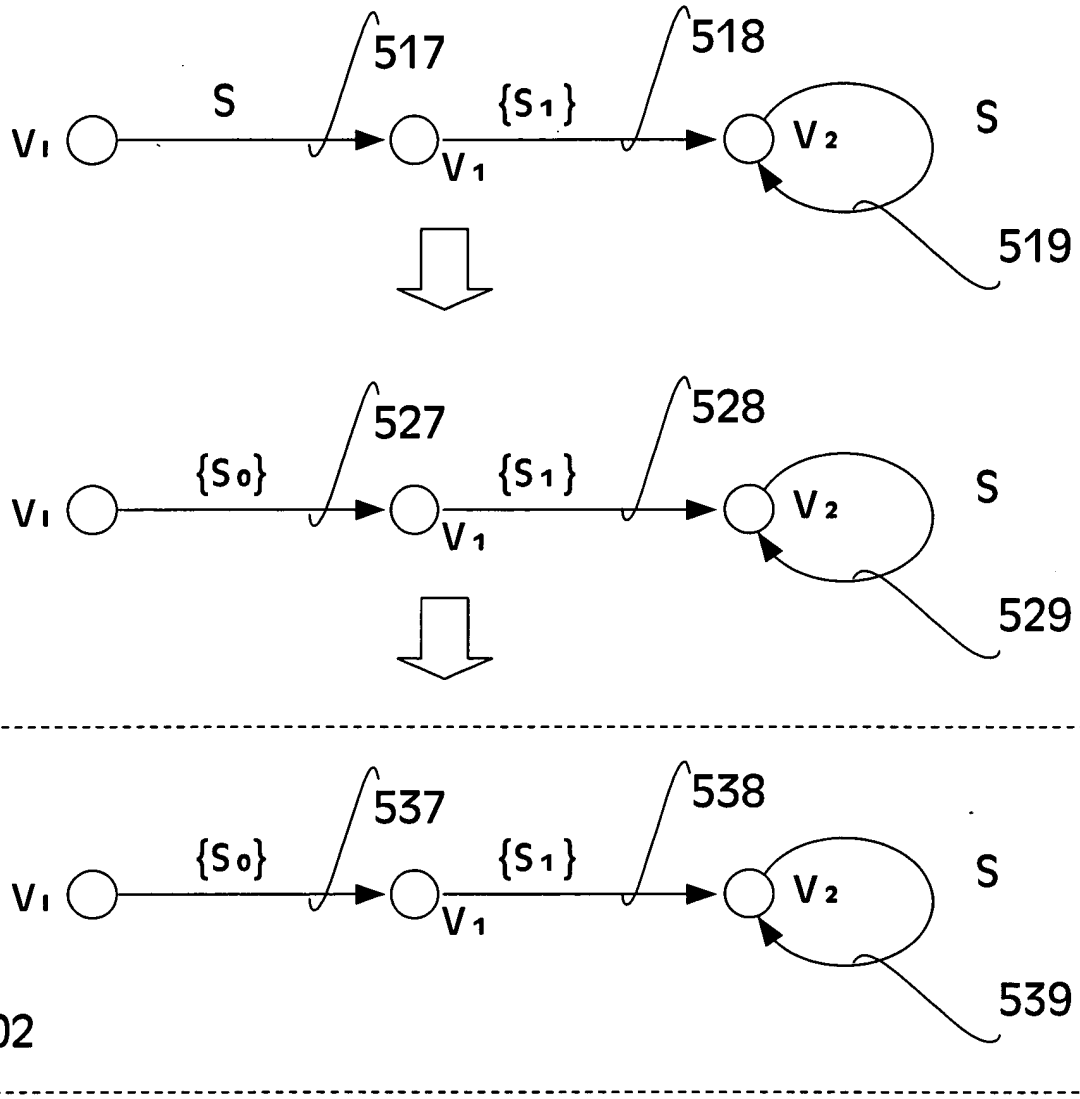

V1
S
517
V1
{S1}
518
V2
S
519
V1
{S0}
527
V1
{S1}
528
V2
S
529
V1
{S0}
537
V1
{S1}
538
V2
S
539
502

FIG. 5b

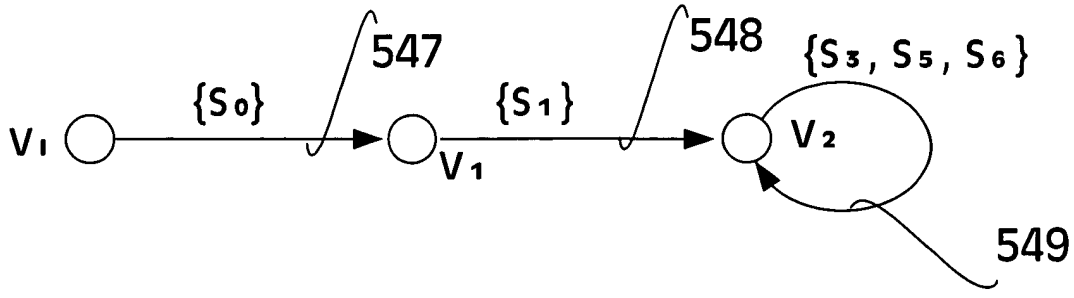

V1
{S0}
547
V1
{S1}
548
{S3, S5, S6}
V2
549

FIG. 6a

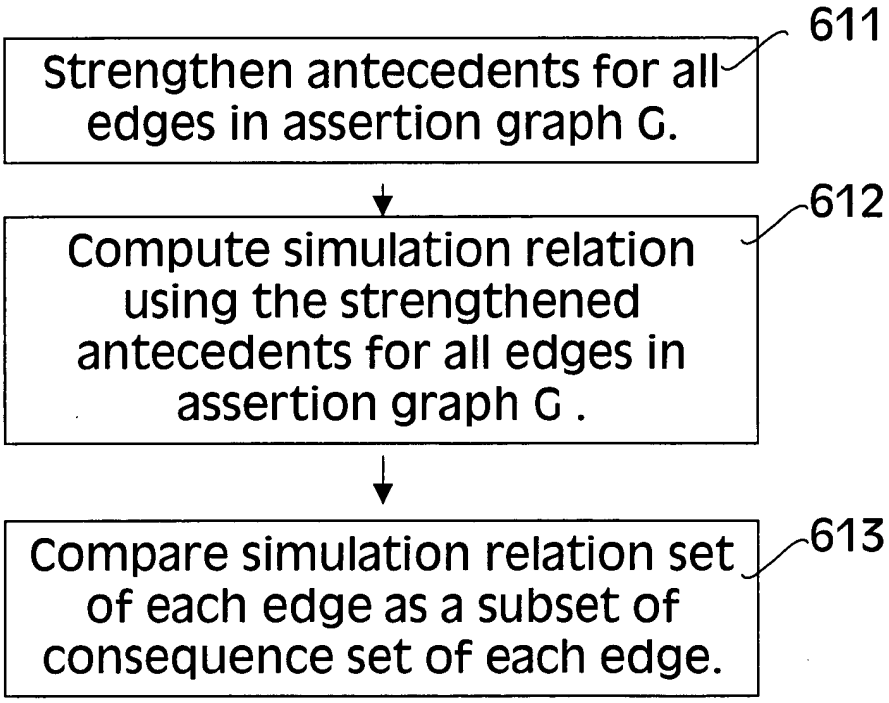

Strengthen antecedents for all edges in assertion graph G.
611
Compute simulation relation using the strengthened antecedents for all edges in assertion graph G .
612
Compare simulation relation set of each edge as a subset of consequence set of each edge.
613

FIG. 6b

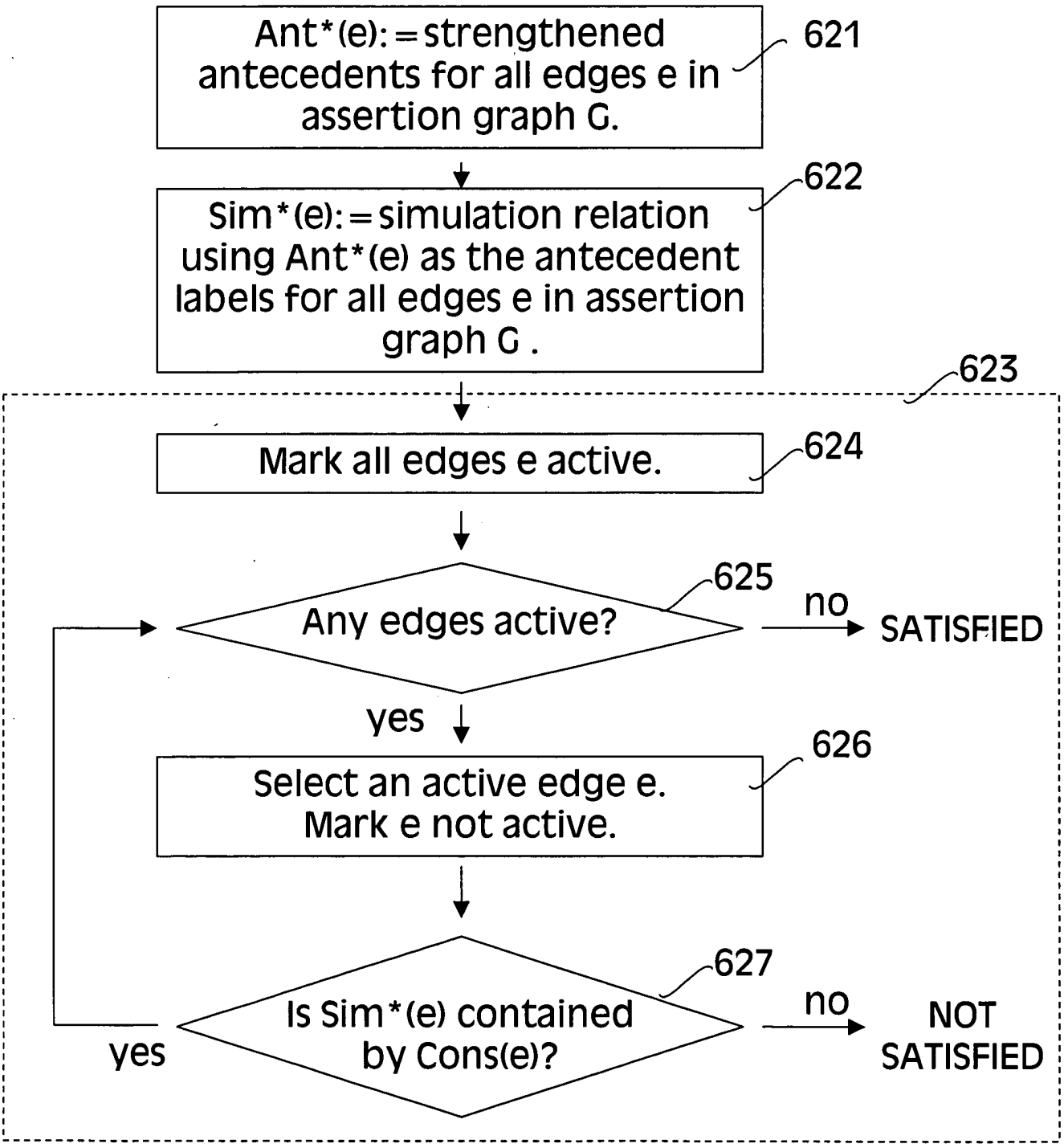

Ant*(e):=strengthened antecedents for all edges e in assertion graph G.
621
Sim*(e):=simulation relation using Ant*(e) as the antecedent labels for all edges e in assertion graph G .
622
623
Mark all edges e active.
624
Any edges active?
625
no
SATISFIED
yes
Select an active edge e. Mark e not active.
626
Is Sim*(e) contained by Cons(e)?
627
no
NOT SATISFIED
yes

FIG. 7

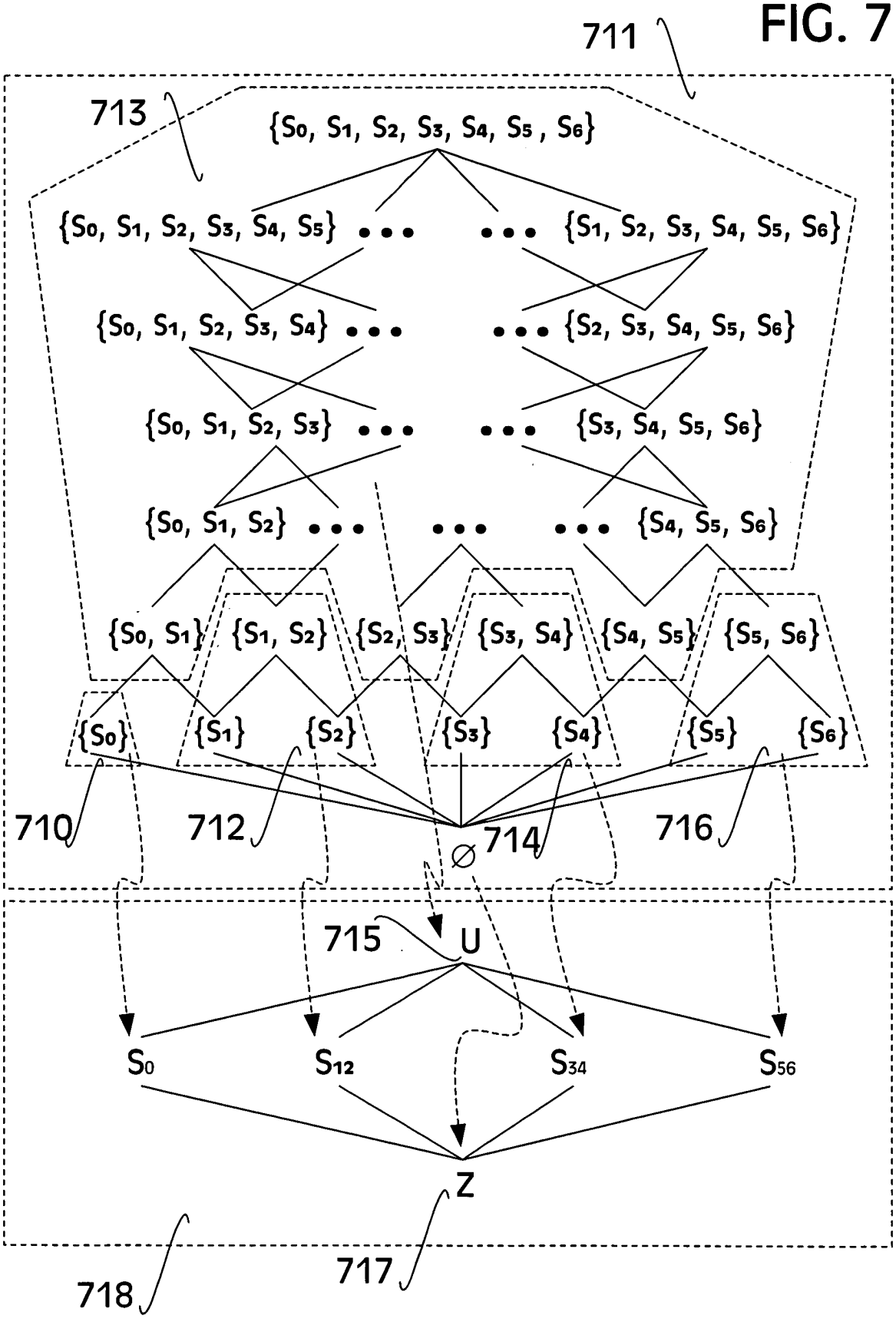

711
713
{S0, S1, S2, S3, S4, S5, S6}
{S0, S1, S2, S3, S4, S5}
{S1, S2, S3, S4, S5, S6}
{S0, S1, S2, S3, S4}
{S2, S3, S4, S5, S6}
{S0, S1, S2, S3}
{S3, S4, S5, S6}
{S0, S1, S2}
{S4, S5, S6}
{S0, S1}
{S1, S2}
{S2, S3}
{S3, S4}
{S4, S5}
{S5, S6}
{S0}
{S1}
{S2}
{S3}
{S4}
{S5}
{S6}
710
712
714
716
∅
715
U
S0
S12
S34
S56
Z
717
718

FIG. 8a

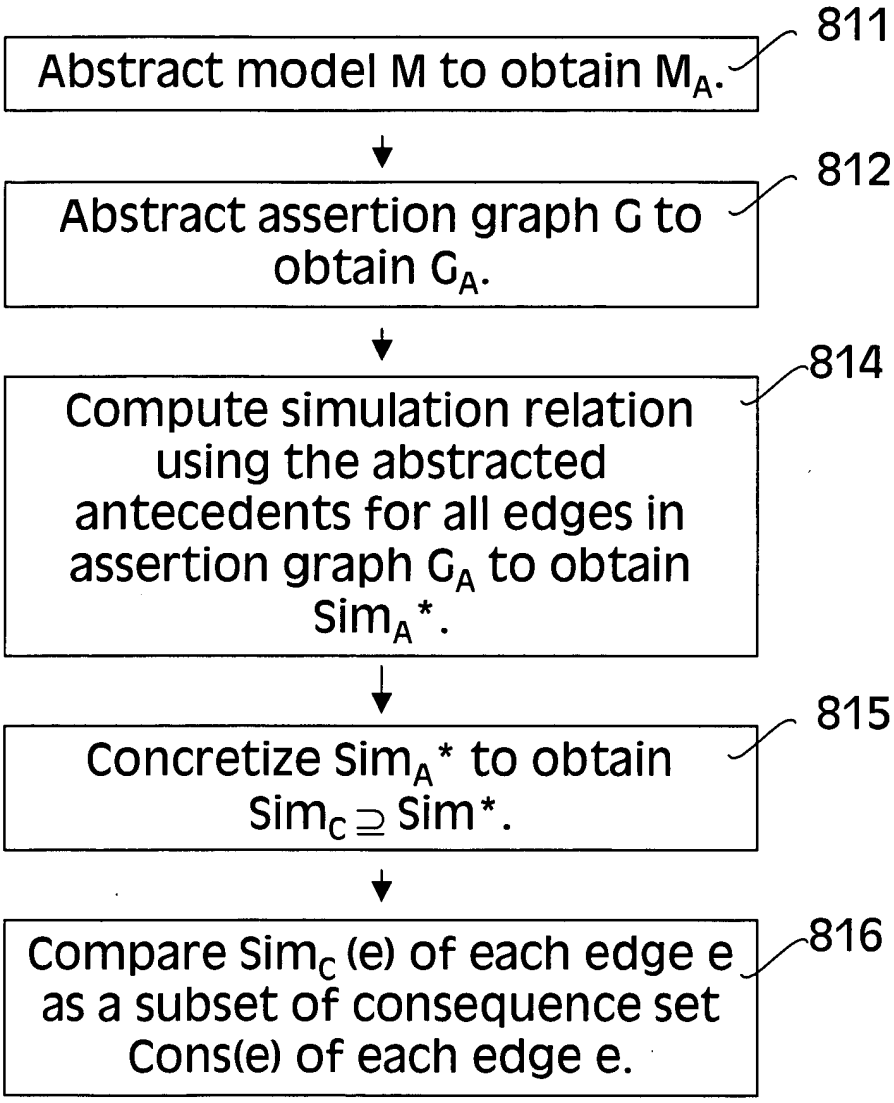

811
Abstract model M to obtain M_A.
812
Abstract assertion graph G to obtain G_A.
814
Compute simulation relation using the abstracted antecedents for all edges in assertion graph G_A to obtain Sim_A^*.
815
Concretize Sim_A^* to obtain $Sim_C \supseteq Sim^*$.
816
Compare Sim_C (e) of each edge e as a subset of consequence set Cons(e) of each edge e.

FIG. 8b

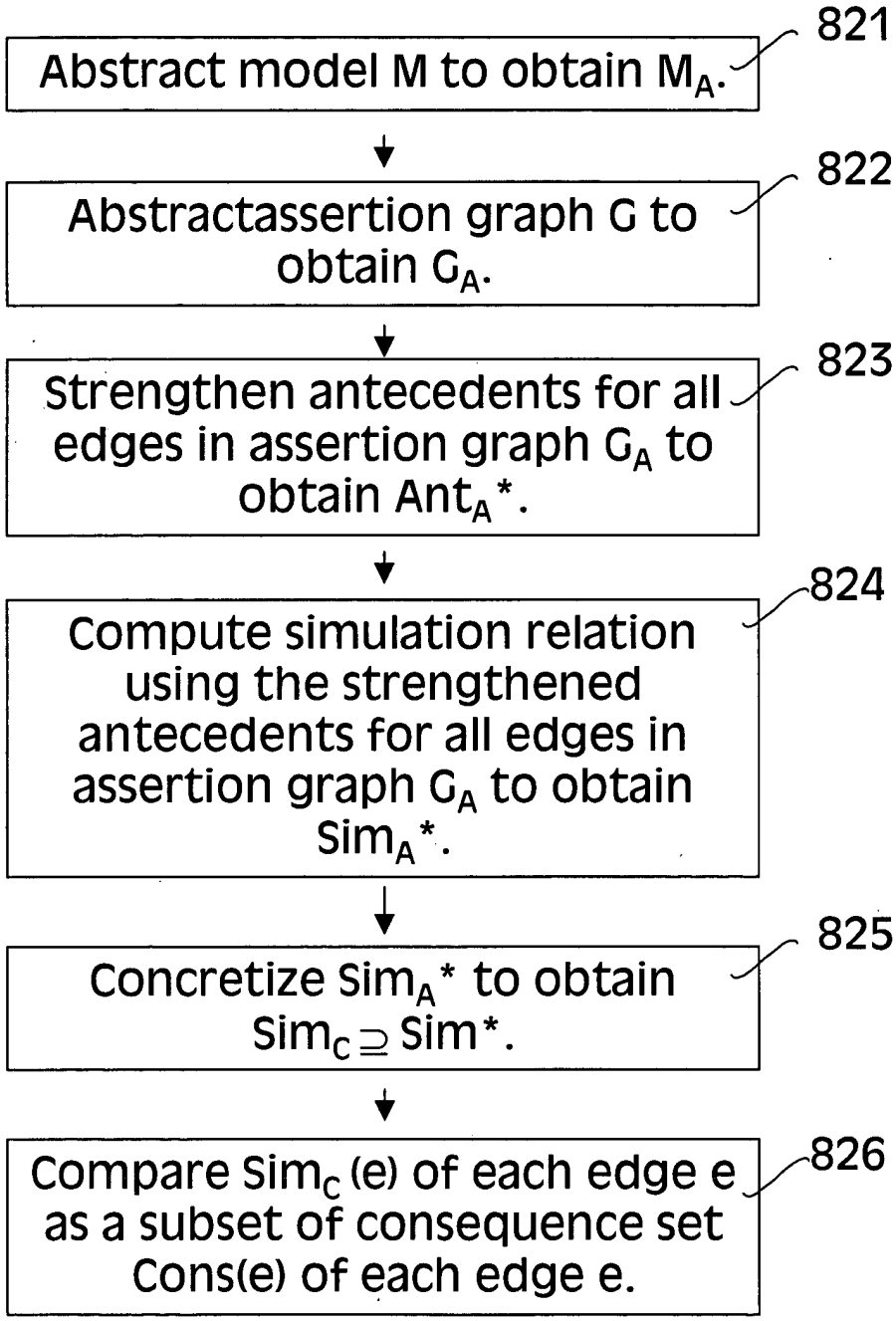

Abstract model M to obtain M_A.
821
Abstractassertion graph G to obtain G_A.
822
Strengthen antecedents for all edges in assertion graph G_A to obtain Ant_A^*.
823
Compute simulation relation using the strengthened antecedents for all edges in assertion graph G_A to obtain Sim_A^*.
824
Concretize Sim_A^* to obtain $Sim_C \supseteq Sim^*$.
825
Compare $Sim_C(e)$ of each edge e as a subset of consequence set Cons(e) of each edge e.
826

FIG. 8c

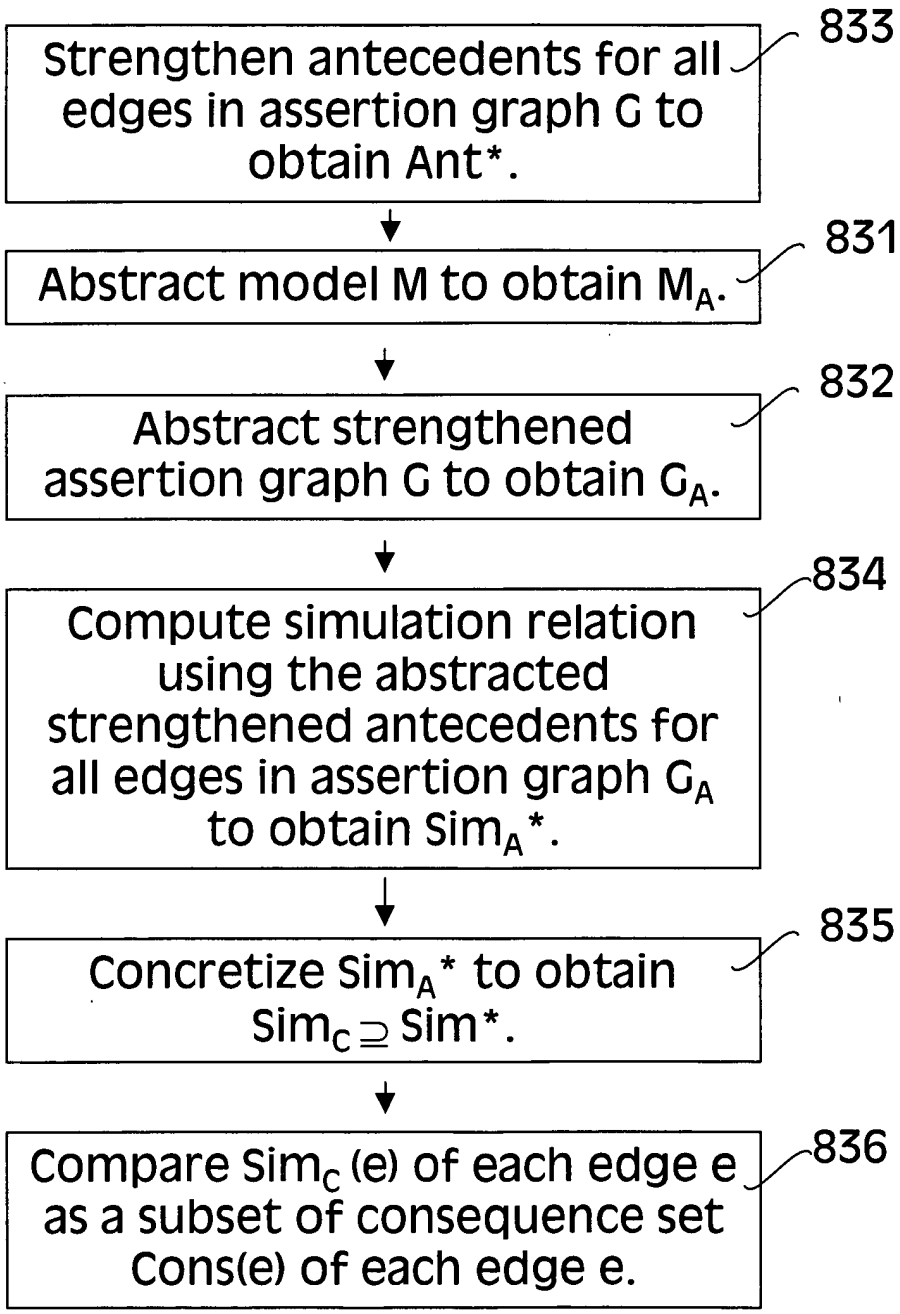

Strengthen antecedents for all edges in assertion graph G to obtain Ant*.
833
Abstract model M to obtain M_A.
831
Abstract strengthened assertion graph G to obtain G_A.
832
Compute simulation relation using the abstracted strengthened antecedents for all edges in assertion graph G_A to obtain Sim_A*.
834
Concretize Sim_A* to obtain $Sim_C \supseteq Sim$*.
835
Compare Sim_C (e) of each edge e as a subset of consequence set Cons(e) of each edge e.
836

FIG. 9

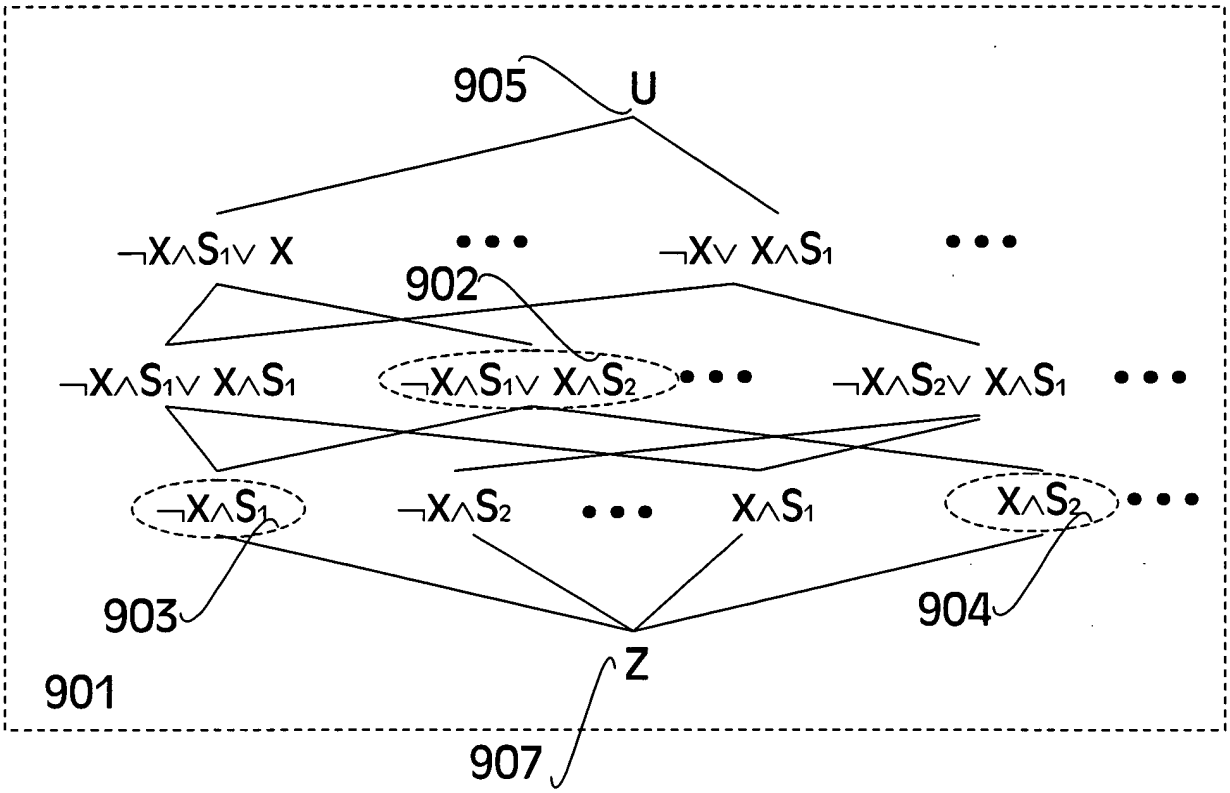

905
U
¬X∧S1∨ X
¬X∨ X∧S1
902
¬X∧S1∨ X∧S1
¬X∧S1∨ X∧S2
¬X∧S2∨ X∧S1
¬X∧S1
¬X∧S2
X∧S1
X∧S2
903
904
Z
901
907

FIG. 10

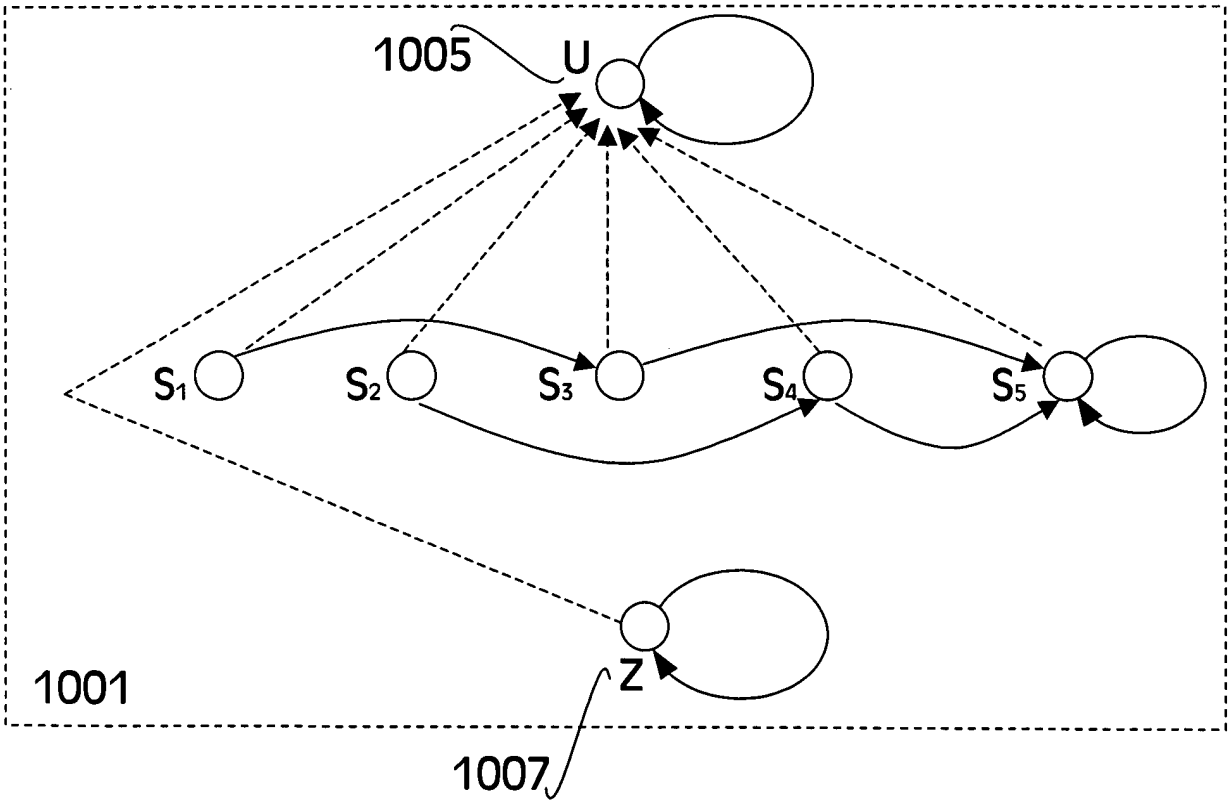

1005
U
S1
S2
S3
S4
S5
Z
1001
1007

FIG. 11a

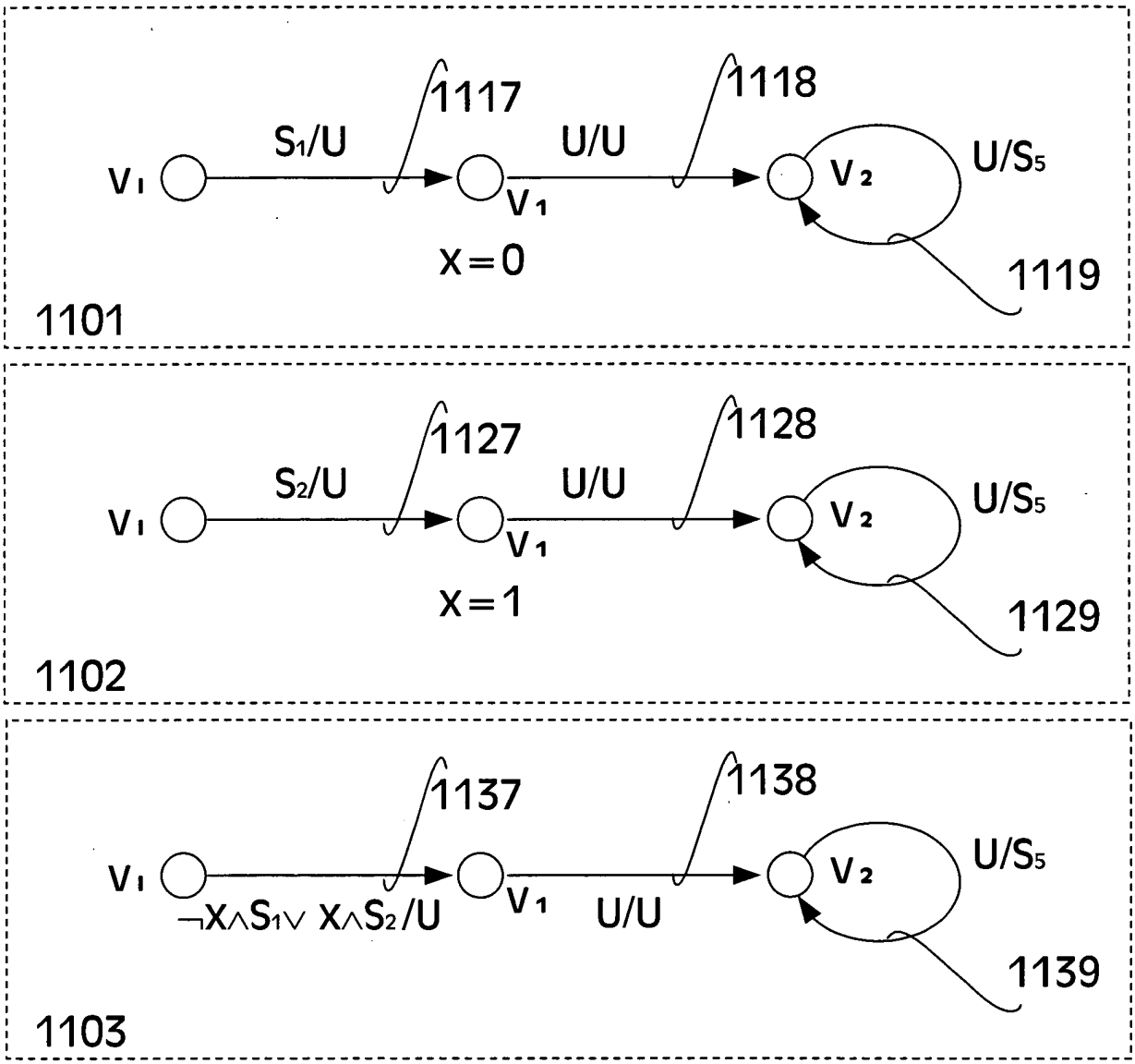


FIG. 11b

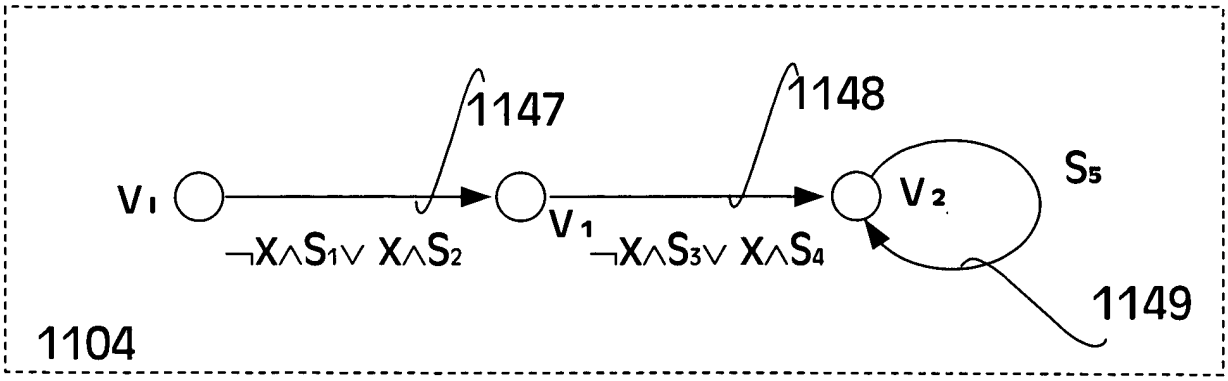


FIG. 12a

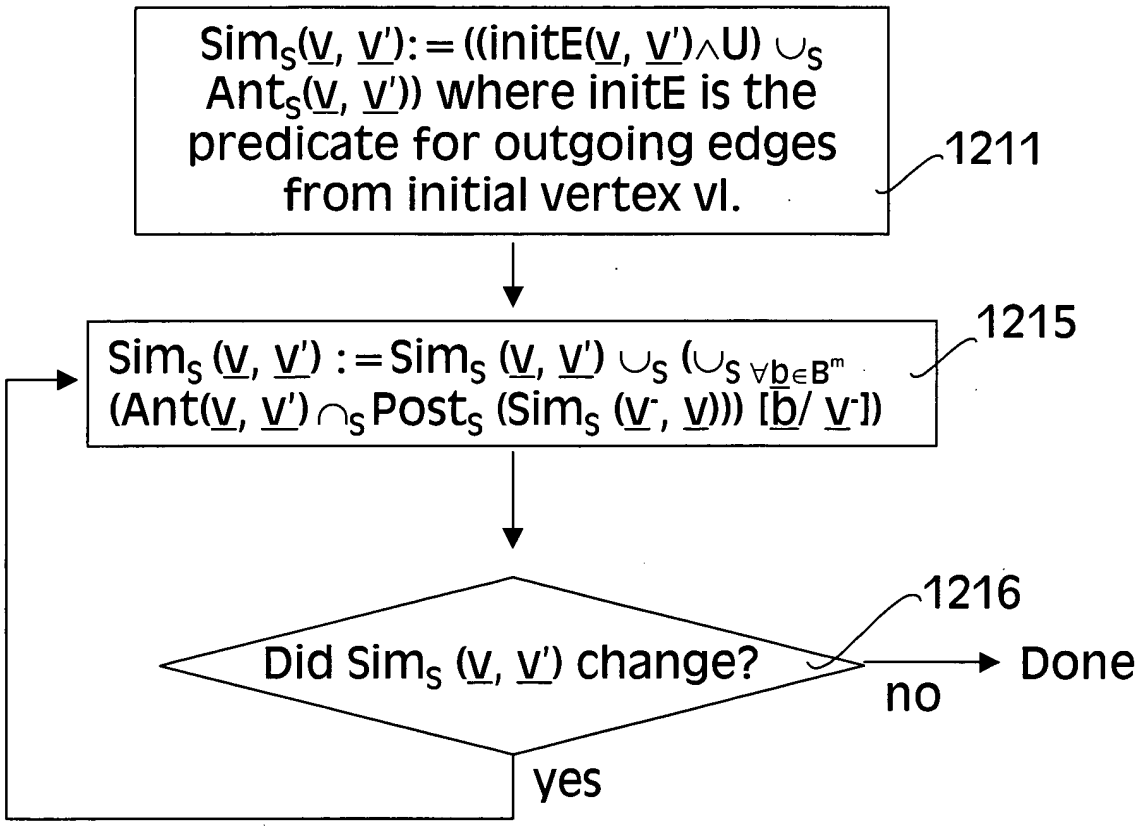
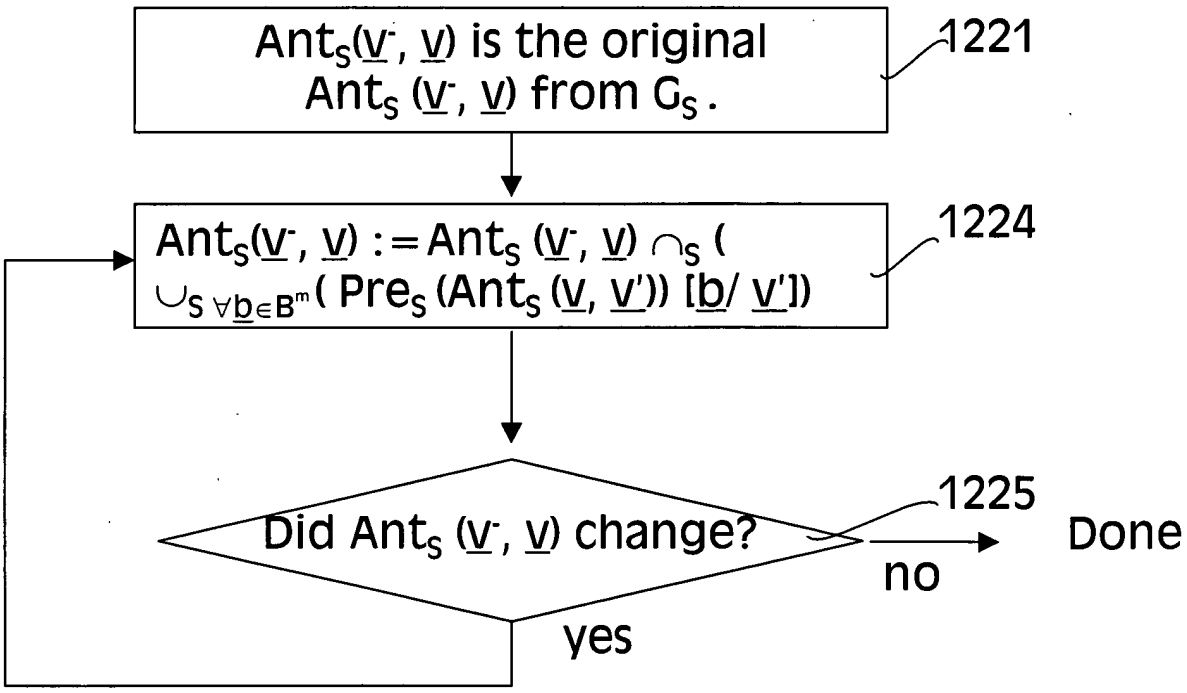

$Sim_S(\underline{v}, \underline{v}') := ((initE(\underline{v}, \underline{v}') \wedge U) \cup_S Ant_S(\underline{v}, \underline{v}'))$ where initE is the predicate for outgoing edges from initial vertex vl.
1211
$Sim_S(\underline{v}, \underline{v}') := Sim_S(\underline{v}, \underline{v}') \cup_S (\cup_{S\ \forall \underline{b} \in B^m} (Ant(\underline{v}, \underline{v}') \cap_S Post_S(Sim_S(\underline{v}^-, \underline{v}))) [\underline{b}/\underline{v}^-])$
1215
Did $Sim_S(\underline{v}, \underline{v}')$ change?
1216
no
Done
yes

FIG. 12b


$Ant_S(\underline{v}^-, \underline{v})$ is the original $Ant_S(\underline{v}^-, \underline{v})$ from G_S.
1221
$Ant_S(\underline{v}^-, \underline{v}) := Ant_S(\underline{v}^-, \underline{v}) \cap_S (\cup_S \forall \underline{b} \in B^m (Pre_S(Ant_S(\underline{v}, \underline{v}'))[\underline{b}/\underline{v}'])$
1224
Did $Ant_S(\underline{v}^-, \underline{v})$ change?
1225
no
Done
yes